

# **Supplemental Meteorological and Oceanographic (METOC) Imager (SMI) Concept**

Dr. Jeffery Puschell  
Raytheon Santa Barbara Remote Sensing  
GEOMET Activity  
Santa Barbara, CA

Phone: (805) 562-7053    Fax: (805) 562-7767    email: [jjpuschell@west.raytheon.com](mailto:jjpuschell@west.raytheon.com)  
N0001498WX30373

## **LONG-TERM GOAL**

The long term goal of this project is to define an approach for placing low-cost meteorological sensors on geosynchronous satellites to provide near real-time high resolution visual and infrared meteorological and oceanographic (METOC) imagery to U.S. Navy Ships at sea in the Indian Ocean and South-West Asia forward operating area.

## **OBJECTIVES**

- (1) Develop detailed sensor performance specifications including spectral bands, radiometric sensitivity for each band, radiometric accuracy for each band, ground sampling distance in each band, temporal coverage, image registration, data rate, data format, power, weight, size, and environmental requirements based upon specified Naval requirements.
- (2) Develop a sensor design that optimally meets the desired performance specifications, identify spacecraft buses and required interfaces, and estimate the life-cycle cost of developing, building and operating multiple Supplemental METOC Imagers (SMIs).

## **APPROACH**

Naval requirements were defined and trade studies were initiated to determine the baseline architecture for the SMI. Alternative approaches were investigated for the scanner, telescope, aft-optics, detector array architecture, and cooler in order to define a baseline, which minimized sensor complexity and cost to achieve the required threshold level of performance based on a qualitative engineering assessment. The baseline architecture was then evaluated using plausible alternatives according to cost and performance figures of merit.

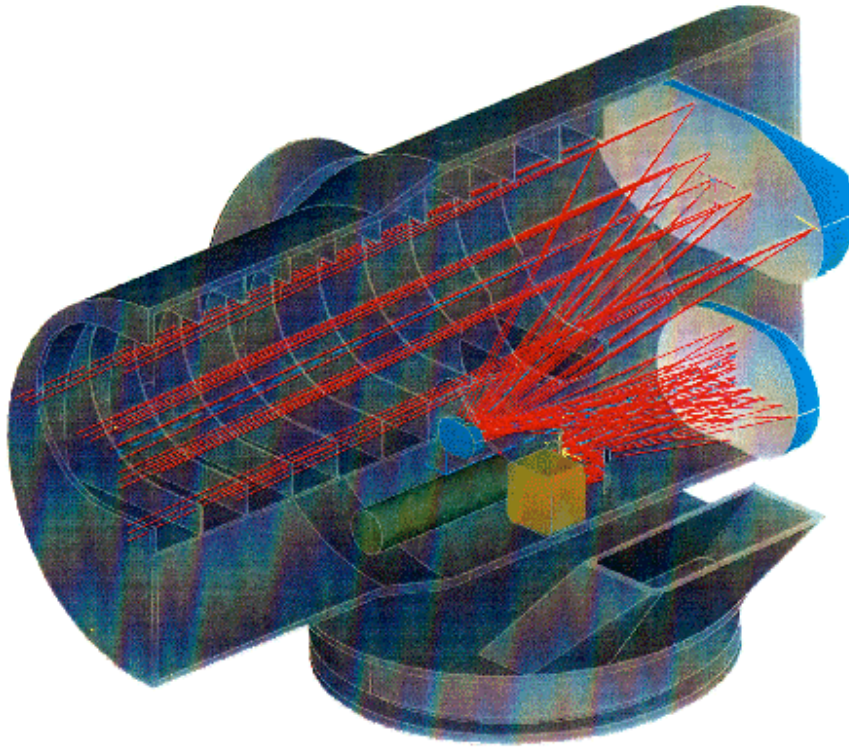
## **WORK COMPLETED**

A Supplemental METOC Imager (SMI) Concept study was completed which contained a design for the SMI fully meeting the requirements, which were defined. Additional design considerations were identified which will require further investigation, candidate spacecraft including commercial Comsats were identified, and life cycle cost estimates were generated.

## **RESULTS**

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>1998</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-1998 to 00-00-1998</b>	
4. TITLE AND SUBTITLE <b>Supplemental Meteorological and Oceanographic (METOC) Imager (SMI) Concept</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Raytheon Santa Barbara Remote Sensing, GEOMET Activity, Santa Barbara, CA, 93109</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>See also ADM002252.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>3</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

Figure (1) provides a view of the proposed concept design for the SMI sensor. The SMI sensor consists of a 30 cm off axis telescope mounted on a two-axis gimbal.

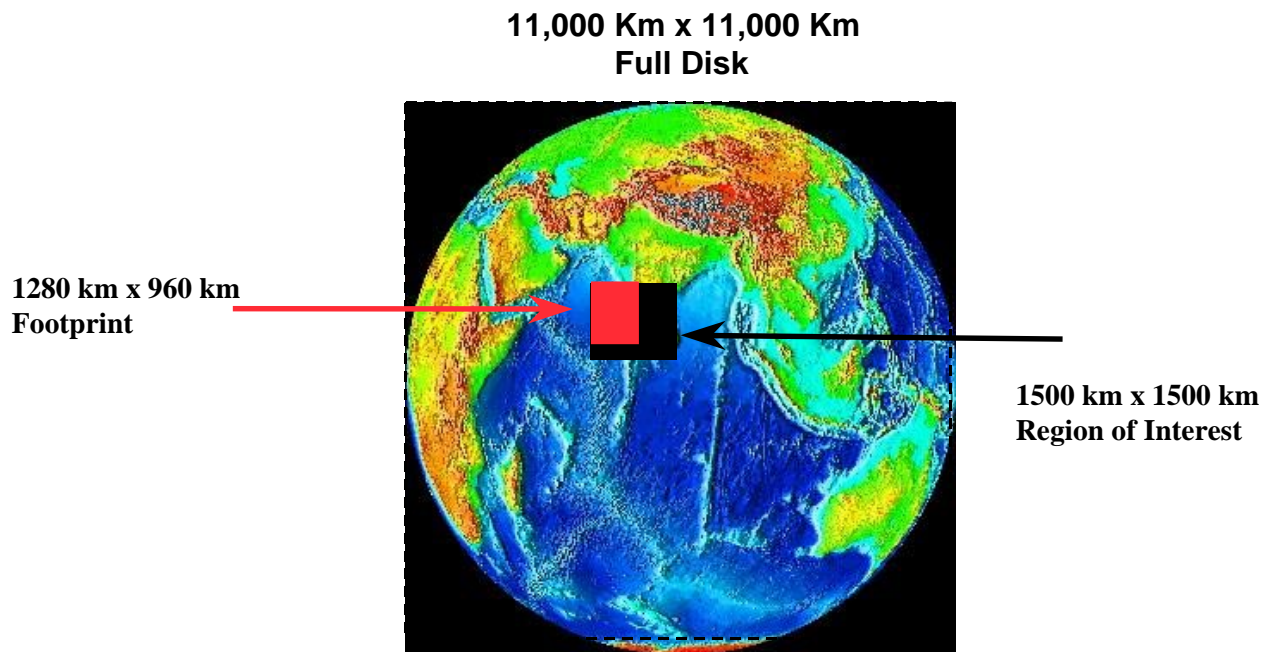


***Figure 1. SMI Sensor Concept***

This design provides a compact package, which minimizes impact on the spacecraft and mitigates solar intrusion by eliminating the exposed scan mirror and results in no image rotation. It provides good thermal stability and a wide field of view enabling more efficient earth coverage by allowing the use of 2-d focal plane arrays. The dichroic beamsplitter provides simultaneous spatial sampling of the visible and infrared bands. A 1280 x 1280 CCD array is used to provide full disk visual coverage, and a 320 x 240 uncooled array with a filter wheel provides the required IR bands and coverage at a low cost. The performance of these arrays is expected to continue to increase as this technology improves making their use in this design even more cost effective. The SMI design has a projected mass of 82 Kg, a projected volume of 0.5 m<sup>3</sup>, and a projected power of 80 W (average) 120 W (peak).

Figure (2) shows the projected coverage for the SMI design. The SMI will provide visible and infrared images showing clouds, storm, water vapor, winds, and surface temperature. It will provide 1 km resolution in the visual band (0.55 to 0.75  $\mu\text{m}$ ) and 4 km resolution in three infrared bands (9.7 to 11.2  $\mu\text{m}$ , 10.2 to 11.2  $\mu\text{m}$ , and 13.1 to 13.6  $\mu\text{m}$ ). Full disk revisit time is 42 minutes, and only 1.3 minutes for a 1500 km x 1500 km specific region of interest. The data rate required for these revisit times

would be about 450 kbps and meet the requirement to be compatible with the existing Navy AN/SMQ-11 system.



*Figure 2. SMI Image Capability*

## **IMPACT/APPLICATION**

The results of this study have created a design concept for an imager which could be deployed as an additional payload on a military or commercial geosynchronous communications satellite to provide the Fleet Commander-In-Chiefs with beneficial tactical meteorological and oceanographic information currently not available in a timely or reliable manner.

## **RELATED PROJECTS**

NA

## **REFERENCES**

NA

## **PUBLICATIONS**

NA